## **Electricity Markets with Strategic Agents Possessing Asymmetric Information**

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#### **Problem**

#### **Emerging Cyber-Physical Systems**

Physical laws, Strategic Decision Makers, Asymmetric Information

#### **Electricity Grid**

Integrated Flow with Trans. Constraints, Non-storable energy Unpredictable Demand, Inelastic Demand, Unpredictable Supply (Esp. renewables)

#### **Electricity Restructuring**

Introducing markets to the industry Decentralized control Strategic profit maximizers Private cost functions

#### **Questions**

Which services should be put to market? How to run the market? What will be the market performance?

## Methodology

#### **Control Theory**

Hypothetical controller

- Central decision maker
- Fully informed
- Social welfare maximizer



Best achievable performance

#### **Theory of Incentives**

Strategic Behavior Asymmetric Information



Conditions for best performance

## **Mechanism Design**

**Budget Balance Individual Rationality** Incentive Compatibility Price efficiency

☆ Guidelines to design the market which achieves best performance



Guidelines for suboptimal markets

### **Research Direction**

## Markets to study

Electricity trade markets Markets for generation expansion planning Static and dynamic form of the markets

# Implications of the Results

Results applicable to other CPS with specific set of physical rules, strategic agents and asymmetric information